
कृषि उत्पाद का धूमन — रीति संहिता
भाग 5 सामान्य आवश्यकताएँ
(पहला पुनरीक्षण)

**Fumigation of Agricultural Produce
— Code of Practice
Part 5 General Requirements
(First Revision)**

ICS 65.040.20

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FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Foodgrains, Allied Products and Other Agricultural Produce Sectional Committee had been approved by the Food and Agriculture Division Council

The use of fumigants for the control of pests of agricultural importance is on increase in the country. Fumigants, being poisonous chemicals result in toxic manifestations to operators exposed to them during or after fumigation process, if handled carelessly. The fumigation operation can be made safer involving good practices leading to safe and economical use of fumigants and control of the infesting organisms.

This standard (Part 5) is one of the series of Indian Standards on Code of practice for fumigation of agricultural produce. The other parts published in this series are:

Part 1 Methyl bromide

Part 2 Ethylene Dibromide [Withdrawn, as the fumigant has been banned vide S.O. 682 (E) dated 17th July 2001]

Part 3 Aluminium phosphide (Phosphine)

Part 4 Ethylene dichloride and carbon tetrachloride mixture

These parts (Parts 1 to 4), cover the selection, safety and suitable application techniques of individual fumigants.

This standard (Part 5) was published in 1985. This standard recommends the general principles for the use of gases and vapours for the fumigation of buildings, ships' holds, shipping containers, silos.

Manual for Fumigation Operators, Directorate of Plant Protection, Quarantine & Storage has been published by Directorate of Plant Protection, Quarantine & Storage and may be suitably refereed for additional guidance. Also, there may be State specific requirements, which may be referred.

This standard is being revised to incorporate latest technological developments in the field of fumigation of agricultural products and the major changes include:

- a) Fumigation process has been modified;
- b) Step of gas monitoring has been included;
- c) Guideline for waste disposal has been included in detail; and
- d) Record pertaining to fumigation details has been updated as per other modifications.

The composition of the committee responsible for formulation of the standard is listed in Annex A.

In reporting the result of a test made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS 2 : 2022 'Rules for rounding off numerical values (*second revision*)'.

Indian Standard

FUMIGATION OF AGRICULTURAL PRODUCE — CODE OF PRACTICE

PART 5 GENERAL REQUIREMENTS

(First Revision)

1 SCOPE

This standard (Part 5) lays down the general procedures and precautions to be adopted when chemical fumigation for the eradication of storage pests is being carried out.

2 REFERENCES

The standards listed below contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of these standards:

<i>IS No.</i>	<i>Title</i>
IS 1260 (Part 1) : 1973	Pictorial marking for handling and labelling of goods: Part 1 Dangerous goods
IS 3521 (Part 1) : 2021	Personal fall arrest systems specification: Part 1 Full body harness (<i>fourth revision</i>)
IS 6151 (Part 1) : 2020	Storage management code: Part 1 Terminology (<i>first revision</i>)
IS 14166 : 1994	Respiratory protective devices full — Face masks — Specification

3 TERMINOLOGY

For the purpose of this standard, the following definitions in addition to those given in IS 6151 (Part 1) shall apply.

3.1 Fumigant — A chemical which at ambient temperature and pressure can exist in a gaseous state in sufficient concentration and penetrability

and for sufficient time to be lethal to storage pests.

3.2 Fumigation — The process of employment of fumigants for disinfection.

3.3 Fumigation Enclosure — Any space which has been or is intended to be made gas tight to contain the fumigant.

3.4 Risk Area — The area surrounding the fumigation enclosure into which there is any reason to suspect that the fumigant may escape in concentrations hazardous to human beings and animals.

3.5 Authorized Fumigator — That person who is licensed to carry out fumigation, or a trained and experienced person who is in charge of the fumigation.

NOTE — For the purpose of this standard, the term fumigator is taken to mean an authorized fumigator, as defined above.

4 SAFETY REQUIREMENTS

4.1 Safety Equipment

4.1.1 Full Face Canister Type Respirator

The respirator most commonly used is the full face canister respirator used as a combination of respirator face piece and correct canister, in accordance to IS 14166. This apparatus is the most important piece of equipment used for the protection of persons working with fumigants. It is advisable that each operator be supplied with his own respirator and that the fumigator in charge be responsible for its care and maintenance.

4.1.1.1 Each time a full face canister respirator is donned; the following checks should be carried out:

- a) That the correct canister is being used;
- b) That the face piece is the correct fit, by closing the inlet to the canister with the palm of the hand and inhaling deeply; the

- c) vacuum so created should cause the face piece to adhere to the face for at least 15 seconds;
- d) That the shelf life of the canister has not expired (*see 7.2*); and
- e) By reference to the canister log, that the recommended usage time has not been exceeded (*see 7.2*).

NOTE — In no circumstances should a full face canister respirator be used when there is a possibility of exposure to toxic levels of fumigation concentrations or to an atmosphere deficient in oxygen. In such cases self-contained breathing apparatus (SCBA) should be used.

4.1.2 Self-Contained Breathing Apparatus

For emergency use where an operator, must enter area contaminated with toxic levels of a fumigant, a self-contained breathing unit or apparatus complying with IS 14166 shall be worn.

4.1.3 Protective Clothing

All operators when releasing fumigant shall wear protective clothing. Impervious gloves and impervious footwear should, where applicable, be worn.

NOTE — Impervious is taken here to mean impermeable to the relevant fumigant gas., under the conditions of use. Only products known by the fumigator to comply with this requirement should be used.

4.1.4 Safety Harness and Ropes

When any fumigator is required to enter a basement or the hold of a ship or other such area for the purpose of applying fumigant or for rescue purposes, he/she shall wear a safety harness to which is attached a rope by which he/she can be hauled up. All safety harness and lifelines shall comply with IS 3521 (Part 1).

4.1.5 Detection and Monitoring Equipment

The correct gas leak detection and monitoring equipment for the fumigant being used shall be available on every fumigation and shall be kept in efficient working order, for example, gas detector tubes, calibrated electronic monitors and infrared gas analyser.

4.1.6 Torch

An efficient torch shall be available on all fumigations, certified by a recognized testing authority as safe for use in an atmosphere made flammable by the fumigant or any other material such as dust.

4.1.7 Medical Kit

A kit for the treatment of fumigant poisoning shall be available at each fumigation done.

NOTE — Advice on this kit may be obtained from the appropriate State department of health or department responsible for industrial regulations.

4.2 First Aid Instructions

4.2.1 Entering Contaminated Area

Adequate protective equipment shall be used when a contaminated area is to be entered for rescue purpose.

4.2.2 Evacuation of Succumbed Person

A succumbed person shall be removed to fresh air, laid down in a restful position and kept warm.

4.2.3 First Aid Treatment

When an accident occurs, first aid treatment shall be started at once. If possible, one person should begin treatment while another calls a doctor and ambulance giving details of fumigant and circumstances of exposure.

4.2.4 Measures to be Taken While Awaiting Arrival of Medical Aid

Where practicable, the following measures shall be carried out while awaiting the arrival of medical aid:

- a) Apply artificial resuscitation and external cardiac massage, if required;
- b) Loosen all tight clothing;
- c) Remove contaminated clothing including wrist watch and spectacles;
- d) Thoroughly wash contaminated skin with clean water; and
- e) Eye contamination:
 - i) Hold eyelids open and wash eyes immediately with a gentle flow of water;
 - ii) Continue washing until doctor arrives; and
 - iii) Do not use any chemicals, as they may increase the injury.

5 ACTION BEFORE FUMIGATION

5.1 Notification of Authorities and Persons Concerned

5.1.1 Fumigation of a Building or Enclosed Space

A fumigator intending to fumigate a building or other enclosed space shall intimate to the occupant about the intention of fumigation.

5.1.2 Fumigation of a Vessel

The fumigator in-charge, when intending to fumigate a vessel, shall deliver a notice in writing prior to the fumigation about the intention of fumigation.

5.2 Fumigation Warning Signs

The fumigator in-charge for fumigation of any building, vessel or enclosed space should, before the application of the fumigant, affix to each door and other means of access to the fumigation enclosure as prescribed in Fig. 1 with a white background. Information on the notice should be written in capital letters not less than 10 cm high, in contrasting colour to the background.

5.3 Precautions and Tests of Equipment

No person shall commence a fumigation until the following conditions apply:

- a) The fumigator has by personal inspection ascertained that all portions of the fumigation enclosure and risk area have been vacated;
- b) All fires and naked lights within the fumigation enclosure have been extinguished. For flammable fumigants there should be no smoking or carrying of matches and cigarette lighters in the risk area;
- c) All electric points have been thoroughly checked ascertaining that there is no spark while operating the points/buttons. All loose connections have been properly repaired;
- d) Fans as required are in position and tested for efficiency. For flammable fumigants, it is essential that fans and their switches, if any, used within the fumigation enclosure comply with the requirements of hazardous locations;
- e) All cracks, crevices or openings in or between walls and ceilings or roof and floors and all fireplaces in the building, vessel, or other enclosed space about to be fumigated have been sealed to prevent the escape of fumigant from the fumigation enclosure;
- f) All liquids, foods and other items that are not required to be included in the fumigation and might be affected by the fumigant are separated from the fumigation enclosure. Some fumigants are corrosive to some metals. For example, phosphine released from Aluminium phosphide reacts with copper and its alloys and hence electrical items including motors must be protected or removed during treatment;
- g) In case of open area, fumigation shall be carried out either early morning or when there is no wind blowing, that is, in calm atmosphere. Also, avoid fumigation of outdoor stacks with aluminium phosphide (phosphine) during raining;
- h) Fumigator has attached a card to his shirt indicating his name, full address and telephone number, required in case of emergency;
- j) The nearest operable telephone has been located and number noted; and
- k) Fumigator has consulted relevant Indian Standards on specific fumigants as per various parts of IS 7247.



	DANGER KEEP OUT FUMIGATION WITH (NAME OF THE FUMIGANT)	
NAME OF FUMIGATOR		
DATE OF FUMIGATION.....		
DATE OF VENTILATION.....		
TELEPHONE No.		
OPERATOR-IN- CHARGE (If Any)		

FIG. 1 FUMIGATION WARNING NOTICE

6 FUMIGATION PROCEDURE

6.1 Fumigation Process

The efficacy of all fumigants is dependent upon a suitable concentration and duration of fumigation. In the first instance prepare a Fumigation Management Plan of the sequence of operations, and about intimation/permission of the appropriate authority to undertake the work and manpower as well as material requirements. Work out in detail the number of persons to be involved, suitability/preparation of the fumigation enclosure for the treatment, quantity of fumigant required, fumigation accessories including sealing materials, safety devices such as hand gloves, respirators, working condition of the gas leak checkers and monitors and display of warning placards. The Plan must also take into account post-treatment operations such as aeration, waste disposal and issuance of clearance certificate. Read the applicator's instructions, label and SDS (safety data sheet) of the fumigant before application and refer appropriate Government guidelines. Under no circumstance shall be fumigant dosage/application rate be grossly different from the recommended concentration which is based upon scientific experiment.

6.2 Minimum Number of People to Conduct a Fumigation

No matter how small the dosage or how restricted the extent of the fumigation, at least two persons shall always be present during the introduction and removal of the fumigant. One of these should be designated the fumigator and he should ensure that the other fumigation staff receives instructions on the use of protective equipment and first aid measures specific to the fumigation being conducted.

6.3 Ventilation

Provision for ventilation should be made during the preparation of structures for fumigation. Where possible, two openings to facilitate flow-through ventilation should be provided with temporary seals that can be removed from the outside of the fumigation enclosure at the completion of fumigation. Doors, windows or hatches selected for this purpose should be arranged so that they may be opened from the outside of the fumigation enclosure. Where fans are used, these should comply with the requirements of 5.3 (d). Generally, fans should be operated intermittently to allow for desorption of fumigant from commodities. Where fans are run

continuously, no reduction in the nominal ventilation period should be made.

6.4 Introduction of Fumigant

Fumigants should be introduced to the fumigation enclosure in accordance with specific fumigation instructions and safety measures, taking care to ensure that all application equipment is gas tight and that the correct dosage is applied.

6.4.1 The fumigant should be introduced from outside the fumigation enclosure wherever possible.

6.4.2 Whenever a safety harness is required to be worn (*see 4.1.4*), at least one other member of the fumigation staff shall remain in the immediate vicinity and in clear sight of the operator. Adequate provision shall be made to haul out the operator in an emergency.

6.4.3 The fumigant shall not be applied in a manner as to be absorbed in liquid form by goods or structures.

6.4.4 During the liberation of the fumigant and until the fumigation enclosure and risk area are free from danger, any member of the fumigation staff who is in or who enters any part of such areas shall wear a suitable respirator or other approved breathing apparatus. He should wear protective clothing also.

6.5 Watchman

Where the fumigation enclosure and risk area cannot be satisfactorily secured by locking, a watchman shall be on duty. It is recommended that, even on locked premises, a watchman should be present during the exposure period.

6.6 Detection of Leaks

During and after completion of introduction of the fumigant, the fumigator, wearing a respirator, shall inspect visually, and with appropriate detection apparatus, for leaks in equipment and in the fumigation enclosure. The following action should be taken if leaks are detected:

- a) Seal and re-test any leaks located, to ensure that the fumigation enclosure is gas tight; and
- b) In the event of a massive accidental release of fumigant, evacuate the risk area immediately.

6.7 Gas Monitoring

Gas concentrations should be measured at different levels inside the fumigation enclosure, at regular

intervals, to ensure even distribution of the fumigant, retention of effective gas concentration throughout the exposure period and thereby, to predict the success of the treatment before termination of fumigation.

6.8 Removal of Fumigant

At the end of the required fumigation period, the fumigant should be removed by controlled release into the atmosphere, ensuring that the following conditions are complied with:

- a) That the risk area is free from all unauthorized persons;
- b) That the fumigation team is properly equipped for fumigation; and
- c) That ventilation of the fumigation enclosure is done by mechanical means, where applicable/available; where mechanical ventilation is not available, that the enclosure is unsealed in sections to allow gradual release of the fumigant. Where natural ventilation is insufficient for rapid clearing of the gas, fans may be utilized, but operators should retire from the risk area for at least 30 minutes immediately after switching on the fans.

6.9 Checking for Clearance

The risk area shall be checked for clearance of the fumigant as follows:

- a) The fumigation team shall be properly equipped in accordance with 3 and after a sufficient period of ventilation, shall check the concentration of fumigant in the risk area and, if it is acceptably low, should proceed to check the fumigation enclosure; anti, and
- b) Upon excessively high concentration of fumigant being detected, the fumigant team shall retire, wait a further period of time and recommence the check procedure until all sections of the fumigation enclosure have been proved safe for re-entry.

6.10 Waste Disposal

Proper disposal of wastes is an integral part of fumigation. Used aluminium flasks in the case of aluminium phosphide (phosphine) fumigation and used methyl bromide cans or cartridges in methyl bromide treatment must be collected, deactivated, if any residues present and crushed or punctured before sending them for recycling or disposal. Also, following fumigation with aluminium phosphide tablets or pellets, the spent powder residues must be

retrieved from fumigation enclosure, deactivated properly and then disposed.

7 ACTION AFTER FUMIGATION

7.1 Re-Entry into the Fumigation Area

When the fumigant concentrations in the fumigation enclosure and risk area have fallen to a safe working level, operators may re-enter the areas to remove fumigation equipment.

7.2 Use and Care of Respirator Canister

The respirator canister shall always be replaced before either its shelf life has expired or the recommended usage time has been reached. The expiry date of a canister may easily be calculated since each is marked with the date of manufacture and shelf life.

7.3 Canisters should be stored in a cool, dry, well ventilated place away from contamination by any fumigants. The following precautions shall always be observed:

- a) When the canister is attached to the respirator face piece after the top seal is removed, record the date. This is best done by writing the date on a small adhesive label which must be affixed to the canister. This label can be used as a 'log' to record exposure of the canister to the fumigant;
- b) Before using the respirator, remove the cap and the seal over the air inlet valve of the canister. Again, at this time mark the date on the 'log' label. Once this seal is removed, even if there is no exposure to fumigant, replace the canister after a lapse of 6 months;
- c) After any fumigation in which there has been prolonged exposure to low concentrations of the fumigant or
- d) accidental exposure to high concentrations, immediately discard the canister. As a guide, on hour of wearing is the usual period after which a canister should be discarded. This could be extended to two hours only when exposure is minimal. Allow a wide margin of safety in estimating exposure times as canisters cost little in terms of health of the individual. If there is any doubt about the exposure life of the canister, discard it;
- e) When canisters are discarded, they should be rendered unusable by mutilating the inlet

port and disposed of under conditions which will prevent them from being picked up and used again; and

- f) Canisters that show any sign of external damage must be considered worthless, and shall be discarded. A severe blow on the metal covering may cause displacement of the contents, permitting contaminated air to pass through to the wearer.

NOTE — Immersion of the canister in water renders it useless. Water may enter the canister through the face piece. Disconnect the hose and canister when cleaning or disinfecting the face piece.

7.4 Fumigation Records

Every person in charge of a fumigation shall keep a record of the fumigation which shall include details of the following:

- a) Address of fumigation enclosure;

- b) Type of fumigation (Stack/shipping container/ship's hold/silo);
- c) Commodity (name, moisture content, infestation present, previous fumigation history);
- d) Fumigant used, dosage, method of application and exposure period;
- e) Fumigation commencing date and time;
- f) Temperature and humidity conditions inside the enclosure;
- g) Gas concentration data;
- h) Fumigation clearance date and time;
- j) Waste disposal details;
- k) Copies of all notices submitted; and
- m) Results of fumigation. This information should be retained for examination by the concerned authorities on demand.

ANNEX A
(Foreword)
COMMITTEE COMPOSITION

Foodgrains, Allied Products and Other Agricultural Produce Sectional Committee, FAD 16

<i>Organization</i>	<i>Representative(s)</i>
Directorate of Marketing and Inspection, Ministry of Agriculture, New Delhi	DR NACHIKET KOTWALIWALE (Chairperson)
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Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the website- www.bis.gov.in or www.standardsbis.

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